SCARABÆIDÆ, COLEOPTERA; OBSERVATIONS ON SPECIES UNRECORDED OR LITTLE-KNOWN IN NEW JERSEY[1]

By Robert J. Sim, Agent

Bureau of Entomology, United States Department of Agriculture

Since the 1909 edition of Smith's "Insects of New Jersey," three foreign beetles of the family Scarabæidæ have been identified and recognized as pests within the commonwealth. The studies of *Popillia japonica* Newm., *Phyllopertha orientalis* Waterh. and *Autoserica castanea* Arr. have necessitated rather careful investigations of the native members of the same family. These investigations involve not only the collecting and field observations of adult beetles, but the rearing of numerous unknown larvæ as well. Such activities have made it possible for the writer to add a number of names to the list of Scarabæidæ already recorded for New Jersey.

Of the 163 species mentioned in Smith's list, 117 records have been duplicated within the past five years and twenty-two additional species have been found. Of about forty-five species not relocated, probably some have become either locally extinct or extremely rare, owing to forest fires and to the encroachments of civilization. Others are likely restricted to limited areas not yet sufficiently examined at the proper seasons. It is to be remembered that with many insects the annual periods of specific abundance are very short; then, too, a species may become really common only at intervals of several years.

Southern New Jersey—the coastal plains region—has been more thoroughly studied than that portion of the state lying above the fall line. Practically all of the low country is composed of sand or gravel; much of it is covered with a wild growth of pines and oaks. Certain portions, as the Delaware Valley and a narrow strip along the coast, are characterized by old farm

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lands with pastures, wood-lots, orchards, fields and gardens. All this, with our mild climate, forms an excellent breeding ground for many Scarabæidæ. A number of southern species are included in our lowland fauna; while a few isolated hills, rising to perhaps 200 feet elevation, harbor several insects which are more likely to be met with in North Jersey or across the Delaware in Pennsylvania. Also, some things have been found which apparently did not adhere to any definite rule involving altitude.

It will be remembered that in a general way the scarab family is composed of two great groups; first, those species which subsist upon refuse organic matter, and second, those which in the adult stage feed upon living vegetable tissue—chiefly leaves, flowers and fruits. There is, however, a smaller group which seems to be transitional or at least intermediate. The food of these is fungi—chiefly if not exclusively of terrestrial forms. Of the twenty-two native Scarabæids to be added to Smith's list, ten belong to the first group, that is, they are coprophagous in habit; four, we believe, are strictly mycetophagous in habit; while the remaining eight are purely phytophagous. Below is a list of New Jersey scarabæids not mentioned in Smith's paper.

1. *Onthophagus cribricollis* Hn.
2. *Aphodius erraticus* (Linn.)
3. *Aphodius hæmorrhoidalis* (Linn.)
4. *Aphodius crassulus* Hn.
5. *Aphodius stupidus* Hn.
6. *Aphodius lentus* Hn.
7. *Aphodius campestris* Blatch.
8. *Aphodius serval* Say
9. *Aphodius prodromus* (Brahm)
10. *Dialytes striatulus* (Say)
11. *Odontæus darlingtoni* Wallis
12. *Odontæus simi* Wallis
13. *Odontæus liebecki* Wallis
14. *Bolbocerosoma tumefactum* (Beauv.)
15. *Serica carolina* Daws.
16. *Serica opposita* Daws.
17. *Serica lecontei* Daws.
18. *Serica georgiana* Leng
19. *Serica cuculata* Daws.
20. *Phyllophaga diffinis* (Blanch.)
21. *Phyllophaga subtonsa* (Lec.)
22. *Anomala nigropicta* Csy.

Onthophagus cribricollis Hn. was first reported for New Jersey by Charles Schaeffer. He collected two specimens at Lakehurst and published the record in the Journal of the New York Entomological Society for December, 1914, but gave no date. In the Frank Heimbach collection, we have two old specimens labeled "Five-mile Beach, N. J., April 20"—no year given. I found them in the series of *O. pennsylvanicus.* My own records began with June 25, 1926, when one was found under a rabbit pellet in the small Pine Barren at Rancocas Park, five miles from Mount Holly. Between that date and July 9, seventy specimens were collected under rabbit droppings in the same place; twenty-seven being taken on July 4. In 1927, fifty were collected in the same locality, all within an area one-eighth mile in diameter. The best days were July 20 and 21, on each of which twelve of the beetles were collected. All specimens were taken at rabbit pellets. Thus, two seasons' collecting resulted in 120 specimens. The beetles were most active on warm sunny days after showers, and practically all were found between 9 A. M. and noon. None was ever observed on the wing in the afternoon or on a cloudy morning. As in all species of *Onthophagus* whose habits are known to me, *cribricollis* buries its food where found and sinks it vertically to a depth of a few inches, where the subsequent grub lives in a double-walled plaster cell of its own manufacture. The entire metamorphosis was found to require about one month. As in other species, this beetle probably overwinters as a hibernating adult buried singly at a depth of several inches. One feature of *cribricollis* not hitherto mentioned in descriptions is that a well developed male has a distinct single median tubercle near the anterior thoracic margin, very similar to that of *O. anthracinus* Harold of the Southwest.

Aphodius erraticus (Linn.) is an introduced European species common in some of the higher portions of the Eastern States. Three specimens were found in a hillside cow pasture of the Watchung Mountains near Pluckamin, New Jersey, on May 28, 1925. Another individual was seen among the sand dunes at Seaside Park on a subsequent date not recorded. This is a lively, active species.

Aphodius hæmorrhoidalis (Linn.). An European species now quite abundant throughout New Jersey. My first date for it is May 20, 1925, when several were taken in a cow pasture near Freehold, New Jersey.

Aphodius crassulus Hn. A very small shining black species described from Florida and now added to the New Jersey list on the strength of two specimens taken by the writer in 1929. These were found in deer droppings in a moist thicket of the Pine Barrens between Medford and Indian Mills on June 3 and 11. Our two specimens differ slightly from those of Horn's small series in having the elytral intervals concave instead of flat. This produces an effect unique among *Aphodii* so far as I know.

Aphodius stupidus Hn. March 27, 1925, is, I believe, the first New Jersey date for this. On that day one beetle was collected at Rancocas Park by H. C. Hallock. My records—all for the same locality—begin with April 3, 1927, when one specimen was taken. None appeared during the summer but between October 7 and 31, fourteen additional ones were collected. *Stupidus* is a dull species both in appearance and actions.

Aphodius lentus Hn. is more generously represented. Eighteen individuals have been collected at Rancocas Park, the first date being May 25, 1927. That and the following year totaled three, the latest date being June 3. The year 1929 was more productive; eleven specimens for May 20 and four for June 1. In the Pine Barrens between Medford and Indian Mills, thirteen *lentus* were found in deer droppings on June 11 and 14. As the name implies, this seems to be a spring species. It is a sluggish insect and further resembles *stupidus* in having an inconspicuous vesture of fine pubescence. It is, however, usually smaller, brighter brown and lacks the frontal tubercles of the foregoing species.

Aphodius campestris Blatch. Superficially similar to *stercorosus* Melsh. and no doubt confused with it in previous records. *Campestris* differs in possessing the following characters: The pronotum distinctly margined posteriorly, the elytra sparsely pubescent near external margin towards apex, the first hind tarsal joint less elongate. It seems to be a spring and early summer species, common in the sandy Pine Barrens. For a definite record Rancocas Park, May 20, 1929, is given.

Aphodius serval Say. This small species somewhat resembles *distinctus* (Mull.) but is usually smaller and has two minute denticles on the clypeus. The first New Jersey specimen was brought in by R. W. Burrell on November 14, 1927, and was collected near Riverton. In 1928, the writer collected three near Riverton as they were flying late in the afternoon of March 25. On March 13, 1929, several more were found under rubbish on the ground in the same locality. None has been found under excrement of any sort, so the feeding habits are not definitely known. It is possible that *serval* normally inhabits the runways of field mice or other small mammals.

Aphodius prodromus (Brahm). This abundant European species, which often fairly swarms in our pastures, so closely resembles *femoralis* Say that it was probably overlooked by the older collectors, or maybe it has only recently become numerous here. *Femoralis* has a nearly uniform dirty-yellowish elytral disk, each elytral interval has a row of close, fairly large punctures near each margin, and the fine punctation of the pronotal disk is quite distinct; while in *prodromus* the elytral disk has a large light wedge-shaped area extending back medially from the base, the rows of punctures on the intervals are much less distinct, and the finer punctures of the pronotum are nearly obsolete. For *prodromus* the following records are offered: Watchung Mountains, September 9, 1925; Riverton, October 16, 1925; Bordentown, May 13, 1926.

Dialytes striatulus (Say). About fifty individuals of this interesting little beetle were collected on June 11, 14, 16 and 18, 1929, at Jericho, New Jersey. They were all found under horse droppings in a damp shaded depression of the old stage road. The elevation at this point is about seventy feet. Many other likely places in the neighborhood were carefully gone over but no further specimens were discovered. Otherwise, I have taken this species only on the mountains of Pennsylvania and Maryland. It might be mentioned here that *D. truncatus* (Melsh.) has been found to be abundant on the mountains aforesaid and has been recorded for the region of Lake Hopatcong, New Jersey, but on July 15 and 20, 1929, more than 100 examples were discovered in deer excrement in the Pine Barrens. These were in

the locality mentioned for *Aphodius lentus,* between Medford and Indian Mills. The elevation at that point is given as 100 feet.

This closes the discussion of the coprophagous scarabæids added to our list.

Now we turn to those little-known beetles which I believe to be fungus feeders. The only reference to this that I have found is in *Social Life in The Insect World,* by that observant French naturalist, J. H. Fabre. In this book is a chapter headed "The Truffle-hunter (*Bolboceras gallicus*)" = *Bolbelasmus gallicum* (Muls.). This beetle, related to our *Bolboceras,* he found feeding upon *Hydnocystis arenaria,* a subterranean fungus resembling the truffle. Several years' digging of the subterranean tunnels of species of *Bolboceras, Bolbocerosoma, Eucanthus* and *Odontæus* failed to throw any light upon the feeding habits of these mysterious insects. Then on October 11, 1928, when excavating the burrow of an *Odontæus* in Rancocas Park, I came upon a beetle an inch or two beneath the surface, associated with a small greenish-gray mass of jelly-like substance. Further digging in the same locality within a day or so yielded similar results, but in one case the gelatinous mass was enveloped in a tough skin similar to that of a puff-ball (*Lycoperdon,* for instance). All this material, including the beetles themselves, was taken to the laboratory where Mr. M. C. Swingle made microscope slides of the fungus substance and the insects' stomach contents. In each case there were elliptical greenish spores scattered through a matrix of colorless jelly. The slides, together with an alcoholic specimen of a complete fungus, were sent to Minnie M. Johnson, of Ohio, who identified the mycological material as a peculiar subterranean fungus named *Rhizopogon pachyphloes* Z. & D. The beetles from this station were subsequently submitted to J. B. Wallis, of Winnipeg, and were described by him under the name of—

Odontæus darlingtoni. My first specimens of this were taken at Rancocas Park (the type locality) on October 25, 1926. Since then they have been found regularly burrowing in the sand under the pines of that place from October to March. Just to see if the above described experience could be duplicated, I

visited the location on January 8, 1930, and unearthed two males and two females in individual burrows, and one of the beetles was found to have collected a mass of *Rhizopogon* jelly. Thus, it will be seen that *darlingtoni* is our winter *Odontœus,* just as *blackburni* is our winter representative of *Geotrupes.*

Odontœus simi Wallis. The type locality for the present species is the golf course at Merchantville, New Jersey. This seems to be a characteristic habitat. Throughout July and August the little beetles give evidence of their presence on green and fairway by pushing up small but conspicuous piles of sand. This and three other beetles of the same general group are considered pests by greenskeepers on account of their habit of thus marring the appearance of the golf courses with their little sand piles. *Simi* has been found, also, associated with *darlingtoni* at Rancocas Park, in a pine-oak bush-lot near Riverside and associated with *liebecki* on Arney's Mount.

Odontœus liebecki Wallis. This species is more distinctly characteristic of higher elevations. Unlike the preceding beetle which frequently works in open sunny places, *liebecki* is most likely to be found burrowing on the upper levels of well-shaded hills and mountains. While the beetles, of course, frequently have their homes under the leaf carpet of the forest floor, their diggings are much more easily found along some old wood road of which the little used wheel tracks are bare. For New Jersey records I mention the Jenny Jump Mountains, August 17, 1929, and Arney's Mount, August 30, 1927.

Bolbocerosoma tumefactum (Beauv.) is another beetle which has frequently been reported as a pest on golf courses. The work of this is very similar to that of the *Odontœus* and *Eucanthus* in the same localities. In addition to golf courses, it frequents old roadways which are not too well shaded. Most of my specimens were collected in such a spot near Rancocas. Between August 21 and October 3, 1927, seventy-five *tumefactum* were collected there.

Of the six New Jersey species belonging to the present group, *Odontœus darlingtoni* is the only one so far found associated with any food material, but it is believed that all related species and

genera will eventually be found to be feeders upon subterranean fungi.

The following insects are all strictly phytophagous.

Serica carolina Daws. Thus far not frequently met with in New Jersey. My only records are one specimen found in the wash-up at Seaside Park, June 20, 1926, and one taken at night on Hooton Hill, June 13, 1928.

Serica opposita Daws. The first record for this exceedingly abundant species seems to be May 25, 1919, when type material was collected at Riverton by J. J. Davis. At least along the edges of the Pine Barren area, *opposita* is the most common and evenly distributed of all our *Serica*. Its hours of activity begin at dusk and various oaks are the favorite food plants.

Serica lecontei Daws. A locally common species on the higher grounds and in certain parts of the Pine Barren. The localities given by Dawson are Bergen County, Lahaway, Ocean County, Fort Lee District, Ridgewood, Phillipsburg and Browns Mills Junction. No dates are given. Two of my own collecting dates are Arney's Mount, June 26, 1926, and Hooton Hill, June 28, 1928.

Serica georgiana Leng. Taken in some abundance on a wooded hill near Langhorne, Pennsylvania, but apparently less common in New Jersey. I have it recorded only for Arney's Mount, June 22, 1926.

Serica cuculata Daws. Several of this rather large shining blackish-brown species were collected on Hooton Hill on June 9 and June 16, 1928. They were found resting under dead leaves on the ground in the daytime and feeding upon the leaves of oak and chestnut bushes at dusk.

Phyllophaga diffinis (Blanch.). A rather small dark member of the genus and apparently somewhat southern in distribution. In 1926, thirty-three specimens were collected at Rancocas Park between May 13 and June 13. In 1927, sixteen were collected in the same locality between May 13 and June 8. Some were taken from under the leaf carpet during the daytime and others were collected at night feeding upon the foliage of black jack and black oak and persimmon. While usually somewhat smaller,

diffinis bears a general resemblance to *forsteri* Burm., but the male has a much longer antennal club.

Phyllophaga subtonsa (Lec.). Of this large fine pubescent species, I have two old Anglesea specimens collected by H. W. and H. A. Wenzel. One is marked July 3 and the other July 7, but no year is given. My first date records one specimen taken near Riverton on May 14, 1924. Most of the New Jersey material has been collected near the top of Arney's Mount. In May and June 2, 1926 to 1928, ten specimens were collected there by scratching away the dead leaves on the ground. The locality has not been visited at night, but since oak species are prevalent on this wooded hill, probably they form the favorite food plants of *subtonsa*.

Anomala nigropicta Csy. Usually our most common *Anomala*. It may be found in numbers lying beneath the dead leaves in woodlands during the daytime and at night is very active, sometimes swarming among the foliage of maples, or feeding in rose blossoms. It is present throughout spring and early summer. For definite dates we give Rancocas Park, May 11, 1927, and Riverton, July 12, 1927. During July each year, it has been found feeding in large numbers after dark upon the flowers of the Japanese chestnut.